WE CLAIM:

1. Methods for the manufacture of composites of finely powdered fillers in a polymer matrix comprising the steps of:

forming a solution of the polymer in volatilizable solvent;

mixing filler material particles with sufficient solution to form a suspension having therein the balance in volume percent of the polymer required for the composite;

evaporating solvent from the suspension while subjecting it to high shear treatment so as to maintain distribution of filler particles in the solution, the evaporation being continued until a mixture is obtained consisting essentially of filler particles with the residual solution distributed therein, the mixture being of consistency suitable for production of thin coherent layers;

producing thin coherent layers from the mixture;

continuing evaporation of solvent from the thin coherent layers until it has substantially entirely been removed;

placing a stack of a plurality the thin coherent layers in a mold in sufficient number to obtain a composite article of the desired thickness; and

subjecting the stack of thin coherent layers to a temperature sufficient to melt the polymer material and to a pressure sufficient to unite the layers and to maintain the melted polymer material dispersed in the interstices between the filler material particles.

2. A method as claimed in claim 1, wherein the thin coherent layers are of thickness from 0.0125mm (0.0005in) to 0.01mm (0.004in).

3. A method as claimed in claim 1, wherein the stack in the mold consists of from 6 to 120 thin coherent layers.

4. A method as claimed in claim 1, wherein the thin coherent layers are thick enough to be self-sustaining and are formed by extrusion as a strip, ribbon or film.

5. A method as claimed in claim 1, wherein the composite is a highly filled material comprising from 60 to 97 by volume percent of filler material particles.

6. A method as claimed in claim 1, wherein the stack of thin coherent layers is heated to a temperature in the range 280-400°C and to a pressure in the range 3.5 to 1,380 MPa (500 to 200,000psi), preferably 70 to 1,380 MPa (10,000 to 200,000psi).

7. A method as claimed in claim 1, wherein the filler material particles are selected from the group comprising particles of inorganic material, particles of electromagnetic material, particles of a core of inorganic material covered with a layer of a metal oxide material, particles of metal material, particles of magnetic material, and particles of low dielectric constant high melting point polymer material, all of which particles may be hollow.

8. A method as claimed in claim 7, wherein the filler material particles are of size in the range 0.1 to 50 micrometers, and consist of a mixture of filler material particles of different chemical compositions.

9. A method as claimed in claim 1, comprising also the steps of:

evaporating the solvent from the suspension in a high shear mixer/evaporator to form an extrudable mixture;

extruding the extrudable mixture in the form of an extruded continuous strip separable into thin coherent layers;

heating the extruded continuous strip in a drying furnace to remove residual solvent therefrom; and

subjecting a stack of thin coherent layers separated from the extruded continuous strip to the specified temperature and pressure.

10. A method as claimed in claim 9, wherein the solvent is evaporated from the suspension with maintenance of substantial uniformity of distribution in a high shear mixer as disclosed in U.S. Patents Nos. 5,279,463 and 5,538,191.

11. A method as claimed in claim 1, and including the step of applying to a surface of each heated and pressed stack a layer of conductive metal by a process

selected from sputtering and direct bonding of metal foil under heat and pressure in a vacuum.

12. A method as claimed in claim 1, and including the step of forming substrates for electronic circuits from the heated and pressurized stacks.

13. A method as claimed in claim 1, wherein in the step of evaporating solvent from the suspension the distribution of filler particles in the solution is substantially uniform and the residual solution is distributed substantially uniformly, and wherein in the step of subjecting the stack of thin coherent layers to a temperature the melted polymer material is substantially uniformly dispersed in said interstices.

14. Articles consisting of bodies of composite materials comprising finely powdered filler material particles distributed in a polymer matrix;

wherein each body comprises a composite mixture of filler material particles and the balance polymer, the polymer being one which is soluble in a volatilizable solvent that has been volatilized from the mixture;

wherein each body comprises a stack of a plurality of united thin coherent layers in number sufficient to provide a unitary body of the desired thickness; and

wherein the body has been formed from the stack of thin coherent layers by subjecting the stack to a temperature sufficient to melt the polymer and to a pressure sufficient to unite the thin coherent layers into a unitary body and disperse the melted polymer into the interstices between the filler material particles.

15. Articles as claimed in claim 14, wherein body of composite material has been formed from a stack of thin coherent layers of thickness from 0.0125mm (0.0005in) to 0.01mm (0.004in).

16. Articles as claimed in claim 14, wherein the body of composite material has been formed from a stack of from 6 to 120 thin coherent layers.

17. Articles as claimed in claim 14, wherein the filler material particles selected from the group comprising particles of inorganic material, particles of electromagnetic material, particles of a core of inorganic material covered with a layer of a metal oxide material, particles of metal material, particles of magnetic material, and particles of low dielectric constant high melting point polymer material, all of which particles may be hollow.

18. Articles as claimed in claim 17, wherein the filler material particles are of size in the range 0.1 to 50 micrometers, and consist of a mixture of filler material particles of different chemical compositions.

19. Articles as claimed in claim 14, and comprising a layer of conductive metal applied to a surface of the body by sputtering or by direct bonding of conductive metal foil under heat and pressure in a vacuum.

20. Articles as claimed in claim 14, and comprising substrates for electronic circuits formed from the heated and pressurized composite mixture.

21. Articles as claimed in claim 14, wherein the melted polymer is dispersed substantially uniformly into the interstices between the filler material particles.